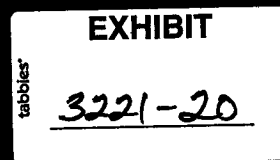


**AN AMERICAN NATIONAL STANDARD**  
**IAPMO/ANSI UPC 1-2003**

# **UNIFORM PLUMBING CODE™**



**ANSI C3**



## CHAPTER 6

### WATER SUPPLY AND DISTRIBUTION

#### 601.0 Running Water Required.

**601.1** Except where not deemed necessary for safety or sanitation by the Authority Having Jurisdiction, each plumbing fixture shall be provided with an adequate supply of potable running water piped thereto in an approved manner, so arranged as to flush and keep it in a clean and sanitary condition without danger of backflow or cross-connection. Water closets and urinals shall be flushed by means of an approved flush tank or flushometer valve. In jurisdictions which adopt Appendix J, water closets, urinals, and trap primers in designated non-residential buildings may be provided with reclaimed water as defined and regulated by Appendix J of this code.

**601.2 Identification of a Potable and Nonpotable Water System.** In all buildings where potable water and nonpotable water systems are installed, each system shall be clearly identified. Each system shall be color coded as follows:

**601.2.1 Potable Water** – Green background with white lettering.

**601.2.2 Nonpotable Water** – Yellow background with black lettering, with the words "Caution: Nonpotable water, do not drink."

Each system shall be identified with a colored band to designate the liquid being conveyed, and the direction of normal flow shall be clearly shown. The minimum size of the letters and length of the color field shall conform to Table 6-1.

A colored identification band shall be indicated every twenty (20) feet (6096 mm) but at least once per room, and shall be visible from the floor level.

Where vacuum breakers or backflow preventers are installed with fixtures listed in Table 14-1, identification of the discharge side may be omitted. Each outlet on the nonpotable water line which could be used for special purposes shall be posted as follows:

"Caution: Nonpotable water, do not drink."

**601.2.3 Reclaimed Water** – Purple (Pantone color #512) background and shall be imprinted in nominal 1/2 in. (12.7 mm) high, black upper case letters, with the words "Caution: Reclaimed water, do not drink."

**601.3** Faucets and diverters shall be connected to the water distribution system so that hot water corresponds to the left side of the fittings.

TABLE 6-1

Minimum Length of Color Field and Size of Letters

Outside Diameter of Pipe or Covering		Minimum Length of Color Field		Minimum Size of Letters	
inches	(mm)	inches	(mm)	inches	(mm)
1/2 to 1-1/4	(15 to 32)	8	(203)	1/2	(12.7)
1-1/2 to 2	(40 to 50)	8	(203)	3/4	(19.1)
2-1/2 to 6	(65 to 150)	12	(305)	1-1/4	(32)
8 to 10	(200 to 250)	24	(619)	2-1/2	(64)
Over 10	(Over 250)	32	(813)	3-1/2	(89)

#### 602.0 Unlawful Connections

**602.1** No installation of potable water supply piping or part thereof shall be made in such a manner that it will be possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter any portion of such piping from any tank, receptor, equipment, or plumbing fixture by reason of back-siphonage, suction, or any other cause, either during normal use and operation thereof or when any such tank, receptor, equipment, or plumbing fixture is flooded or subject to pressure in excess of the operating pressure in the hot or cold water piping.

**602.2** No person shall make a connection or allow one to exist between pipes or conduits carrying domestic water supplied by any public or private water service system, and any pipes, conduits, or fixtures containing or carrying water from any other source or containing or carrying water which has been used for any purpose whatsoever, or any piping carrying chemicals, liquids, gases, or any substances whatsoever, unless there is provided a backflow prevention device approved for the potential hazard and maintained in accordance with this code.

**602.3** No plumbing fixture, device, or construction shall be installed or maintained or shall be connected to any domestic water supply when such installation or connection may provide a possibility of polluting such water supply or may provide a cross-connection between a distributing system of water for drinking and domestic purposes and water which may become contaminated by such plumbing fixture, device, or construction unless there is provided a backflow prevention device approved for the potential hazard.

**602.4** No water piping supplied by any private water supply system shall be connected to any other

source of supply without the approval of the Authority Having Jurisdiction, Health Department, or other Department Having Jurisdiction.

### 603.0 Cross-Connection Control.

Cross-connection control shall be provided in accordance with the provisions of this chapter.

No person shall install any water operated equipment or mechanism, or use any water-treating chemical or substance, if it is found that such equipment, mechanism, chemical, or substance may cause pollution or contamination of the domestic water supply. Such equipment or mechanism may be permitted only when equipped with an approved backflow prevention device or assembly.

**603.1 Approval of Devices or Assemblies.** Before any device or assembly is installed for the prevention of backflow, it shall have first been approved by the Authority Having Jurisdiction. Devices or assemblies shall be tested for conformity with recognized standards or other standards acceptable to the Authority Having Jurisdiction which are consistent with the intent of this code.

All devices or assemblies installed in a potable water supply system for protection against backflow shall be maintained in good working condition by the person or persons having control of such devices or assemblies. The Authority Having Jurisdiction or other department having jurisdiction may inspect such devices or assemblies and, if found to be

**TABLE 6-2**  
**Backflow Prevention Devices, Assemblies, and Methods**

	Degree of Hazard				
Device, Assembly, or Method <sup>1</sup>	Pollution (Low Hazard)		Contamination (High Hazard)		Installation <sup>2,3</sup>
	Back-Siphonage	Back-Pressure	Back-Siphonage	Back-Pressure	
Airgap	x		x		See Table 6-3 in this chapter
Atmospheric Vacuum Breaker	x		x		Upright position. No valve downstream. Minimum of six (6) inches (152 mm) or listed distance above all downstream piping and flood-level rim of receptor. <sup>4,5</sup>
Spill-Proof Pressure-Type Vacuum Breaker	x		x		Upright position. Minimum of six (6) inches (152 mm) or listed distance above all downstream piping and flood-level rim of receptor. <sup>5</sup>
Double Check Valve Backflow Preventer	x	x			Horizontal, unless otherwise listed. Requires one (1) foot (305 mm) minimum clearance at bottom for maintenance. May need platform/ladder for test and repair. Does not discharge water.
Pressure Vacuum Breaker	x		x		Upright position. May have valves downstream. Minimum of twelve (12) inches (305 mm) above all downstream, piping and flood-level rim of receptor. May discharge water.
Reduced Pressure Principle Backflow Preventer	x	x	x	x	Horizontal unless otherwise listed. Requires one (1) foot (305 mm) minimum clearance at bottom for maintenance. May need platform ladder for test and repair. May discharge water.

<sup>1</sup> See description of devices and assemblies in this chapter.

<sup>2</sup> Installation in pit or vault requires previous approval by the Authority Having Jurisdiction.

<sup>3</sup> Refer to general and specific requirement for installation.

<sup>4</sup> Not to be subjected to operating pressure for more than 12 hours in any 24 hour period.

<sup>5</sup> For deck-mounted and equipment-mounted vacuum breaker, see Section 603.4.16.

effective or inoperative, shall require the repair or replacement thereof. No device or assembly shall be removed from use or relocated or other device or assembly substituted, without the approval of the Authority Having Jurisdiction.

## 603.2 Backflow Prevention Devices, Assemblies, and Methods.

**603.2.1 Airgap.** The minimum airgap to afford backflow protection shall be in accordance with Table 6-3.

**603.2.2 Atmospheric Vacuum Breaker (AVB).** An atmospheric vacuum breaker consists of a body, a checking member, and an atmospheric opening.

**603.2.3 Hose Connection Backflow Preventer.** A hose connection backflow preventer consists of two independent check valves with an independent atmospheric vent between and a means of field testing and draining.

**603.2.4 Double Check Valve Backflow Prevention Assembly (DC).** A double check valve backflow prevention assembly consists of two independently acting internally loaded check valves, four properly located test cocks, and two isolation valves.

**603.2.5 Pressure Vacuum Breaker Backflow Prevention Assembly (PVB).** A pressure vacuum breaker backflow prevention assembly consists of a loaded air inlet valve, an internally loaded check valve, two (2) properly located test cocks, and two (2) isolation valves. This device shall be installed outdoors only if provisions for spillage are provided.

**603.2.6 Pressure Vacuum Breaker Spill-Proof Type Backflow Prevention Assembly (SVB).** A pressure type vacuum breaker backflow prevention assembly consisting of one (1) check valve force-loaded closed and an air inlet vent valve force-loaded open to atmosphere,

**TABLE 6-3**  
**Minimum Airgaps for Water Distribution<sup>4</sup>**

Features	When not affected by side walls <sup>1</sup>		When affected by side wall <sup>2</sup>	
	Inches	(mm)	Inches	(mm)
Effective openings <sup>3</sup> not greater than one-half (1/2) inch (12.7 mm) in diameter	1	(25.4)	1-1/2	(38)
Effective openings <sup>3</sup> not greater than three-quarters (3/4) inch (19 mm) in diameter	1-1/2	(38)	2-1/4	(57)
Effective openings <sup>3</sup> not greater than one (1) inch (25 mm) in diameter	2	(51)	3	(76)
Effective openings <sup>3</sup> greater than one (1) inch (25 mm) in diameter	Two (2) times diameter of effective opening		Three (3) times diameter of effective opening	

<sup>1</sup>Side walls, ribs, or similar obstructions do not affect airgaps when spaced from the inside edge of the spout opening a distance greater than three times the diameter of the effective opening for a single wall, or a distance greater than four times the effective opening for two intersecting walls.

<sup>2</sup>Vertical walls, ribs, or similar obstructions extending from the water surface to or above the horizontal plane of the spout opening other than specified in Note 1 above. The effect of three or more such vertical walls or ribs has not been determined. In such cases, the airgap shall be measured from the top of the wall.

<sup>3</sup>The effective opening shall be the minimum cross-sectional area at the seat of the control valve or the supply pipe or tubing which feeds the device or outlet. If two or more lines supply one outlet, the effective opening shall be the sum of the cross-sectional areas of the individual supply lines or the area of the single outlet, whichever is smaller.

<sup>4</sup>Airgaps less than one (1) inch (25.4 mm) shall be approved only as a permanent part of a listed assembly that has been tested under actual backflow conditions with vacuums of 0 to 25 inches (635 mm) of mercury.

positioned downstream of the check valve, and located between and including two (2) tightly closing shutoff valves and test cocks.

### **603.2.7 Reduced Pressure Principle Backflow Prevention Assembly (RP).**

A reduced pressure principle backflow prevention assembly consists of two independently acting internally loaded check valves, a differential pressure relief valve, four properly located test cocks, and two isolation valves.

### **603.3 General Requirements.**

**603.3.1** All assemblies shall conform to listed standards and be acceptable to the Authority Having Jurisdiction with jurisdiction over the selection and installation of backflow prevention assemblies.

**603.3.2** Where more than one (1) backflow prevention valve is installed on a single premise, and the valves are installed in one location, each separate valve shall be permanently identified by the permittee in a manner satisfactory to the Authority Having Jurisdiction.

**603.3.3** The premise owner or responsible person shall have the backflow prevention assembly tested by a certified backflow assembly tester at the time of installation, repair, or relocation and at least on an annual schedule thereafter or more often when required by the Authority Having Jurisdiction. The periodic testing shall be performed in accordance with the procedures referenced in Table 14-1 by a tester qualified in accordance with those standards.

**603.3.4** Access and clearance shall be provided for the required testing, maintenance, and repair. Access and clearance shall require a minimum of one (1) foot (305 mm) between the lowest portion of the assembly and grade, floor, or platform. Installations elevated more than five (5) feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

**603.3.5** Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection. Where potable water is discharged to the drainage system it shall be by means of an approved airgap of two (2) pipe diameters of the supply inlet, but in no case shall the gap be less than one (1) inch (25 mm). Connection may be made to the inlet side of a trap provided that an approved vacuum breaker is installed not less than six (6) inches (152 mm) or the distance according to the device's listing, above the flood-level rim of such trapped fixture, so that at no time will any such device be subjected to any back-pressure.

**603.3.6** Backflow preventers for hot water over 110°F (43.3°C) shall be a type designed to operate at temperatures of 110°F (43.3°C) or more without rendering any portion of the assembly inoperative.

**603.3.7** Fixtures, appliances, or appurtenances with integral backflow preventers or integral airgaps manufactured as a unit shall be installed in accordance with their listing requirements and the manufacturers' instructions.

**603.3.8** In cold climate areas, backflow assemblies and devices shall be protected from freezing by a method acceptable to the Authority Having Jurisdiction.

### **603.4 Specific Requirements.**

**603.4.1** Water closet and urinal flushometer valves shall be equipped with an atmospheric vacuum breaker. The vacuum breaker shall be installed on the discharge side of the flushometer valve with the critical level at least six (6) inches (152 mm) or the distance according to its listing above the overflow rim of a water closet bowl or the highest part of a urinal.

**603.4.2** Water closet and urinal tanks shall be equipped with a ballcock. The ballcock shall be installed with the critical level at least one (1) inch (25.4 mm) above the full opening of the overflow pipe. In cases where the ballcock has a hush tube, the bottom of the water supply inlet shall be installed one (1) inch (25.4 mm) above the full opening of the overflow pipe.

**603.4.3** Water closet flushometer tanks shall be protected against backflow by an approved backflow prevention assembly, device, or method.

### **603.4.4 Heat Exchangers.**

**603.4.4.1** Heat exchangers used for heat transfer, heat recovery, or solar heating shall protect the potable water system from being contaminated by the heat transfer medium. Double-wall heat exchangers shall separate the potable water from the heat transfer medium by providing a space between two walls which is vented to the atmosphere.

**603.4.5** Water supply inlets to tanks, sumps, swimming pools, and other receptacles shall be protected by one of the following means:

- (1) An approved airgap;
- (2) A listed vacuum breaker installed on the discharge side of the last valve with the critical level not less than six (6) inches (152 mm) or in accordance with its listing;
- (3) A backflow preventer suitable for contamination or pollution, installed

accordance with the requirements for that type of device or assembly as set forth in this chapter.

#### **603.4.6 Protection from Lawn Sprinklers and Irrigation Systems.**

**603.4.6.1** Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected from backflow by one of the following devices:

- (1) Atmospheric vacuum breaker
- (2) Pressure vacuum breaker
- (3) Reduced pressure backflow preventer

**603.4.6.2** Where sprinkler and irrigation systems have pumps, connections for pumping equipment, or auxiliary air tanks or are otherwise capable of creating back-pressure, the potable water supply shall be protected by the following type of device if the backflow device is located upstream from the source of back-pressure:

- (1) Reduced pressure backflow preventer

**603.4.6.3** Where systems have a backflow device installed downstream from a potable water supply pump or a potable water supply pump connection, the device shall be one of the following:

- (1) Atmospheric vacuum breaker
- (2) Pressure vacuum breaker
- (3) Reduced pressure backflow preventer

**603.4.6.4** Where systems include a chemical injector or any provisions for chemical injection, the potable water supply shall be protected by the following:

- (1) Reduced pressure backflow preventer

**603.4.7** Potable water outlets with hose attachments, other than water heater drains, boiler drains, and clothes washer connections, shall be protected by a non-removable hose bibb type backflow preventer, a non-removable hose bibb type vacuum breaker, or by an atmospheric vacuum breaker installed at least six (6) inches (152 mm) above the highest point of usage located on the discharge side of the last valve. In climates where freezing temperatures occur, a listed self-draining frost-proof hose bibb with an integral backflow preventer or vacuum breaker shall be used.

#### **603.4.8 DELETED.**

**603.4.9** Water cooled compressors, de-greasers or any other water cooled equipment shall be

protected by a backflow preventer installed in accordance with the requirements of this chapter.  
**Note:**

Water cooled equipment which produces back-pressure shall be equipped with the appropriate protection.

**603.4.10** Water inlets to water supplied aspirators shall be equipped with a vacuum breaker installed in accordance with its listing requirements and this chapter. The discharge shall drain through an air gap. When the tailpiece of a fixture to receive the discharge of an aspirator is used, the air gap shall be located above the flood-level rim of the fixture.

**603.4.11** Potable water make up connections to steam or hot water boilers shall be provided with a listed backflow protection assembly.

**603.4.12 Nonpotable Water Piping.** In cases where it is impractical to correct individual cross-connections on the domestic water line, the line supplying such outlets shall be considered a non-potable water line. No drinking or domestic water outlets shall be connected to the non-potable water line. Whenever possible, all portions of the non-potable water line shall be exposed, and all exposed portions shall be properly identified in a manner satisfactory to the Authority Having Jurisdiction. Each outlet on the non-potable water line which may be used for drinking or domestic purposes shall be posted: "Caution: Non-potable water, do not drink."

**603.4.13** Potable water supply to carbonators shall be protected by either an airgap or a vented backflow preventer for carbonated beverage dispensers installed within the carbonated beverage dispenser. The carbonated beverage dispenser shall bear the label of an approved testing agency, certifying and attesting that such equipment has been tested and inspected and meets the requirements of the approved applicable standard. Carbonated beverage dispensers without an approved internal airgap or vented backflow preventer for carbonated beverage dispensers and carbonated beverage dispensing systems shall have the water supply protected with a vented backflow preventer for carbonated beverage dispensers.

**603.4.14 Water Treatment Units.** Reverse osmosis drinking water treatment units shall meet the requirements of the appropriate standards referenced in Table 14-1. Waste or discharge from reverse osmosis or other types of water treatment units shall enter the drainage system through an airgap.

**603.4.15** Backflow preventers shall not be located in any area containing fumes that are toxic, poisonous, or corrosive.

**603.4.16** Deck-mounted or equipment-mounted vacuum breakers shall be installed in accordance with their listing and the manufacturers' instructions, with the critical level not less than one (1) inch (25.4 mm) above the flood-level rim.

**603.4.17 DELETED.**

**603.4.18 Protection from Fire Systems.**

**603.4.18.1** Except as provided under Sections 603.4.18.2 and 603.4.18.3, potable water supplies to fire protection systems that are normally under pressure, including but not limited to standpipes and automatic sprinkler systems, except in one- or two-family residential sprinkler systems, piped in materials approved for potable water distribution systems shall be protected from back-pressure and back-siphonage by one of the following testable devices:

- (1) Double check valve assembly
- (2) Double check detector assembly
- (3) Reduced pressure backflow preventer
- (4) Reduced pressure detector assembly

Potable water supplies to fire protection systems that are not normally under pressure shall be protected from backflow and shall meet the requirements of the appropriate standards referenced in Table 14-1.

**603.4.18.2** Where fire protection systems supplied from a potable water system include a fire department (siamese) connection which is located less than seventeen hundred (1700) feet (518.2 m) from a non-potable water source that could be used by the fire department as a secondary water supply, the potable water supply shall be protected by one of the following:

- (1) Reduced pressure backflow preventor
- (2) Reduced pressure detector assembly

**Note:**

Non-potable water sources include fire department vehicles carrying water of questionable quality or water that is treated with antifreeze, corrosion inhibitors, or extinguishing agents.

**603.4.18.3** Where antifreeze, corrosion inhibitors, or other chemicals are added to a fire protection system supplied from a potable water supply, the potable water

system shall be protected by one of the following:

- (1) Reduced pressure backflow preventer
- (2) Reduced pressure detector assembly

**603.4.18.4** Whenever a backflow device is installed in the potable water supply to a fire protection system, the hydraulic design of the system shall account for the pressure drop through the backflow device. If such devices are retrofitted for an existing fire protection system, the hydraulics of the sprinkler system design shall be checked to verify that there will be sufficient water pressure available for satisfactory operation of the fire sprinklers.

**603.4.18.5 Residential Sprinkler Systems.**

When residential sprinkler systems are installed using the potable water system they shall be installed in accordance with the standards listed in Table 14-1.

**603.4.19 Special Equipment, Water Supply Protection.** Vacuum breakers for washer-hose bedpans shall be located not less than five (5) feet (1524 mm) above the floor. Hose connections in health care or laboratory areas shall not be less than six (6) feet (1829 mm) above the floor.

**603.4.20** Portable cleaning equipment, dental vacuum pumps, and chemical dispensers shall be protected from backflow by an airgap, an atmospheric vacuum breaker, a spill-proof vacuum breaker, or a reduced pressure principle backflow preventer.

**603.4.21 Water Heater Connectors.** Flexible metallic water heater connectors or reinforced flexible water heater connectors connecting water heaters to the piping system shall be in compliance with the appropriate standards listed in Table 14-1.

**603.4.22** Combination stop-and-waste valves or cocks shall not be installed underground.

**604.0 Materials.**

**604.1** Water distribution pipe, building supply water pipe, and fittings shall be of brass, copper, cast iron, CPVC, galvanized malleable iron, galvanized wrought iron, galvanized steel, PEX, or other approved materials. Asbestos-cement, PE, PVC, PEX-AL-PEX, or PE-AL-PE water pipe manufactured to recognized standards may be used for cold water building supply distribution systems outside a building. PEX-AL-PEX water pipe, tubing, and fittings manufactured to recognized standards may